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GETTING WOMEN INTO COMPUTING

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BACKGROUND

The last decade has seen an expansion in the numbers of students graduating from university or polytechnic with a degree in computing. This expansion has been exclusively male; for women, there has been a decrease in the numbers taking computer science or computer systems engineering degrees. Table 1 shows the numbers of students admitted through the Universities Central Council on Admissions (UCCA) to undergraduate courses in computing over the last eight years; the percentage of female students has dropped steadily from 26% in 1979 to 14% in 1986, and this also represents a drop in actual numbers from 438 to 261. Table 2 shows the numbers of students applying through UCCA for computing courses; the percentage of female applicants has dropped from 27% in 1979 to 13% in 1986, a drop in actual numbers from 918 to 534. The data for Tables 1 and 2 are taken from the UCCA reports for 1978-9 to 1985-6 inclusive [1, 2, 3, 4, 5, 6, 7, 8] (data for computing courses as separate from mathematics courses are not available before 1979). The tables show a peak in female applications and acceptances in 1981 and a steady decline since then. This decrease in actual and percentage terms is despite legislation for equal opportunities at work through the Equal Opportunities Act of 1975 and the changing social climate, with many occupations which were traditionally viewed as

exclusively male now opening up to women. A recent article in the Times [9] by the head of the Industrial Society's Information Technology Department quotes figures which show that in the computing industry, women make up 95% of data preparation staff, 18% of computer programmers and less than 2% of data processing managers. There is concern about the growing disproportion between the numbers of male and female computing students and recently Women into Computing, a national group with network communications, has been established to address the problem. There have been several local projects established with the aim of encouraging young women into computing, including one-week courses for girls at the University of Liverpool and the Lanchester Polytechnic (Coventry), and one-day courses at the Universities of Manchester and Sussex. This article describes a continuing project at the University of Warwick, whose aim is to attract more women into computing both as a career and as a degree course.

INITIATIVES AT WARWICK

In the spring of 1986, a small group of staff in the Department of Computer Science was formed to look into the problem and attempt to come up with some answers. Several initiatives were considered as ways of attracting more female students onto computing degree courses, including specially-designed courses of varying lengths and for varying ages, open days, and visits to schools. Similar initiatives have been developed in other disciplines in which there is a very low participation of women, notably the Insight courses run by the Engineering Industries Training Board and the Women and Physics courses run by the Universities of Manchester, Glasgow and Sussex. As a result of the Warwick group's activities, two different special courses were mounted in 1987 and an open day for girls was held, in addition to the department's usual programme of open days for all prospective students. One of the special courses was a pre-term induction course, open to all first-year undergraduates reading Computer Science or Computer Systems Engineering who had no experience of computing. The aim of the course was to give students the opportunity to use a computer and to start writing Pascal programs in a relaxed, friendly environment with plenty of tutorial support. We felt that the existence of such a course might encourage women (and men) with interest but no previous experience in computing to apply for a place on a degree course. As expected, the proportion of females to males attending the course was very high compared with the first-year intake, with 5 female and 7 male students attending the course out of the total first-year intake of 14 females and 103 males. The rest of this article describes the other special course and the major component

of the project, Warwick WISE, a one-week residential course held in July 1987 for female sixth-form students.

AIMS OF WARWICK WISE

The Warwick WISE course aimed to provide sixth-form girls with the opportunity to work with computers in a stimulating environment and to find out about undergraduate courses and careers for graduates in this field. The course content was designed to provide plenty of practical experience, both in hardware and software construction, and an introduction to the theoretical foundations of computer science. It was important both to cover the subject in sufficient depth to be interesting and to attract participants from all over the country, so we decided on a residential course lasting one week. The number of places was limited to twenty-five so that generous resources, both staff and computing facilities, would be available. Our admissions policy stipulates a good grade in A-level mathematics so we required all applicants to be taking this examination course.

ORGANIZATION

In February 1987, one thousand schools (the schools that sent the most applications to UCCA last year) were sent copies of a leaflet about the Warwick WISE course and inviting applications. Seventy-two applications were subsequently received and selection was made using the following criteria, most important first: academic ability, evidenced by O-level results and a teacher's reference; interest in computing or mathematics (but not necessarily experience of computing); the need for information and guidance. The students selected for the course were of very high academic ability, both in mathematics and other subjects. Six of those selected were studying for a computing science A-level; eleven of the remainder had some previous experience, for example a computing O-level or use of a home micro; the remaining eight had no computing experience at all. They came from all over the country - from Belfast to Devon and from Chester to Kent.

The course included the following elements: practical hands-on sessions on use of computers, including graphic design, text processing, spreadsheet and database programming, an A-level calculus package and an interactive video system; Pascal programming, both lectures and practicals; a microprocessor laboratory in which students

constructed various logic circuits; talks on computing degrees and careers, including visits from four computer professionals, all female Warwick graduates; lectures on computer science foundational material such as algorithms, programs, proofs of correctness, formal language theory and automata; a visit to the IBM Midlands Marketing Centre at Warwick. The practical computing sessions were based on Apple Macintosh personal computers and DEC VAX and Sun minicomputers running UNIX systems. In addition, various social events were organised for the evenings including a sports evening at the University Sports Centre, a film evening, and a barbecue.

FINANCE

The students were charged for their accommodation and meals only, and not for use of computing equipment or staff time, making a total cost of £50 for each student. On top of this they had to find the cost of travel to and from the University and pocket-money. The costs of administering the course, the largest being for printing and distribution of leaflets, were sought from the University Research and Innovations Fund and from the Department of Computer Science itself. We also sought sponsorship of individual places on the course from several companies, both national and local, and were successful in raising sufficient sponsorship to make every place available at a nominal charge of £10. Much of the computing equipment used - the multi-user computer system and six of the personal computers - was supplied by the Department of Computer Science; as the course ran during the second week of the summer vacation this presented no problems to department staff or students. The remainder of the equipment was generously loaned by two companies.

PUBLICITY

An important aspect of a course such as Warwick WISE 87 is the extent to which it can put over to school pupils, their parents and teachers, the idea that computing is worth considering both as an academic subject and as a career. The course makes a direct impact on the students attending, but twenty-five is a small number compared with the total number of sixth-form students in the country; it is worth trying to reach and make some impression on more students, by publicising the course and its aims. The University of

Warwick made two press releases concerning Warwick WISE 87, which gave rise to several articles in the national and local press and two radio interviews. Papers carrying articles included the Daily Telegraph, the New Scientist, the Times Higher Education Supplement, the Teacher, the Coventry Evening Telegraph and the Birmingham Post. The interviews were broadcast on BBC Radio Oxford and BBC Radio Birmingham.

RESULTS

The organization of the course went smoothly, with no problems arising either over accommodation or the course itself. In terms of benefit to the individual participants, the course was most successful. Each student said that she had found the course worthwhile and enjoyable, and there were requests for follow-up courses next year. This extract from a letter received after the course finished is typical of several comments received from the students: "Thank you so much for the Warwick WISE 87 computer course. It was most enjoyable as well as being informative about a career in computers which I am now seriously considering ... I hope you run the course next year so more may benefit from the information you gave us". The tutors also agreed that the course had been very enjoyable and beneficial and wished to run a similar course next summer. All the tutors commented on the lively and pleasant atmosphere on the course, and the intelligence and enthusiasm of the girls.

The most popular elements of the course were the microprocessor laboratory, the Pascal programming sessions under UNIX, and graphic design and text processing on the Macintoshes ("I'm really going to miss this [Mac] next week").

It is too early to tell definitely whether the course has fulfilled the aim of attracting more women students into degree courses in computing. For that, we have to wait until these students have been admitted to university. However, it is worth nothing that, at the end of the week, eight of the students expressed a definite intention to change their planned UCCA application to one for a computing degree, and two more to one with computing options. In more detail, five of the students expressed their intention to change from mathematics or mathematics with computing to computer science or computer systems engineering. One originally design and marketing, one actuarial science and one undecided changed to computer science. Two mathematics changed to maths with computing options. The two students who started the course with a definite intention to study

computing at university confirmed this choice at the end of the week. Of the rest of the students, four remained with their original non-computing choice (psychology, maths, engineering and biology), one remained undecided, and seven were still unsure but considering courses in computer science, computer and management sciences, computing with engineering or accounting, etc. One failed to hand in the questionnaire from which these data were taken. These figures indicate that the course is likely to be proved successful in both reinforcing choices of computing, however tentative at this stage, and in encouraging girls who have not considered computing before. To date the University of Warwick has received applications for places on its computer science and computer systems engineering degrees from seven of the twenty-five students who attended Warwick WISE 1987.

There are also many less tangible or measurable successes of the course. There is no doubt that each of the students who attended the course will return to their school or college with a favourable impression of university life and higher education in computing. They will discuss their experiences with their fellow students and their teachers and pass on the view that the field of computing is not, or does not need to be, dominated by males.

FUTURE PLANS

Plans for Warwick WISE 1988 are already under way. The course will be run on essentially the same principles, incorporating a few minor changes such as increasing the amount of time in the timetable for the microprocessor laboratory and for Pascal programming, and including specialist workshops on image processing and the transputer, graphics programming, circuit construction and advanced programming, on the last day of the course. The time for these sessions will be gained from cutting out some of the applications sessions and from increasing the total length of the course by one half-day. The course will run from 10 to 16 July 1988 and leaflets are being sent to schools to invite applications as before.

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TABLE 1 Candidates accepted through UCCA for computing courses

	M	F	Total
1979	1,269 (74%)	438 (26%)	1,707
1980	1,481 (74%)	515 (26%)	1,996
1981	1,586 (75%)	520 (25%)	2,106
1982	1,489 (78%)	412 (22%)	1,901
1983	1,554 (80%)	381 (20%)	1,935
1984	1,728 (83%)	342 (17%)	2,070
1985	1,585 (87%)	243 (13%)	1,828
1986	1,639 (86%)	261 (14%)	1,900

TABLE 2 Candidates for admission through UCCA for computing courses

	M	F	Total
1979	2,470 (73%)	918 (27%)	3,338
1980	3,331 (74%)	1,165 (26%)	4,496
1981	3,775 (75%)	1,287 (25%)	5,062
1982	3,855 (77%)	1,143 (23%)	4,998
1983	4,248 (80%)	1,083 (20%)	5,331
1984	4,450 (82%)	992 (18%)	5,442
1985	3,872 (86%)	626 (14%)	4,498
1986	3,486 (87%)	534 (13%)	4,020